What Happens to Patients Undergoing Lung Cancer Surgery?*

Outcomes and Quality of Life Before and After Surgery

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Objective: To compare baseline preoperative and 6-month postoperative functional health status and quality of life in patients undergoing lung cancer resection.

Methods: Lung cancer surgery patients from three hospitals were administered the Short-Form 36 Health Survey (SF-36) and the Ferrans and Powers’ quality-of-life index (QLI) before surgery and 6 months after surgery. Preoperative, intraoperative, hospital stay, and 6-month postoperative clinical data were collected. All p values < 0.05 were considered significant.

Results: One hundred thirty-nine patients were studied; 131 patients were discharged and 8 patients (5.8%) died. One hundred three patients (78.6%) who survived underwent an evaluation at 6 months, 16 patients (12.2%) died during follow-up, 2 patients refused follow-up, 4 patients were unavailable for follow-up, and 6 patients are awaiting an evaluation at 6 months. Compared with matched healthy subjects, preoperative lung cancer patients had worse results on the SF-36 physical functioning, role–emotional, mental health, and energy subscales. At 6 months, SF-36 subscales for physical functioning, role–physical, bodily pain, and mental health were significantly worse than preoperative values. The visual analog pain scale was significantly worse at follow-up. The QLI with all subscales and SF-36 for role–emotional, energy, and general health subscales were unaffected by lung cancer resection. Whereas preoperative FEV₁ and 6-min walk results did not predict postoperative functional health status or QLI, a low preoperative diffusion capacity of the lung for carbon monoxide (DLCO) predicted poor postoperative QLI. Preoperative chemoradiation, extent of resection, postoperative complications, or adjuvant therapy did not negatively affect the results of the 6-month QLI or SF-36.

Conclusions: Preoperative functional health status in patients who undergo lung cancer surgery is significantly impaired. A significant number of patients die during the 6 months after surgery. Pain and impairment of functional health status persists for 6 months after lung cancer resection. DLCO, not FEV₁, predicts postoperative quality of life. Preoperative chemoradiation, extent of resection, postoperative complications, or adjuvant therapy do not adversely affect functional health status or quality of life 6 months after surgery. Future studies should focus on risk prediction, technical improvements, and postoperative intervention to improve the functional outcomes and quality of life after lung cancer surgery.

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Key words: functional health status; lung cancer surgery; outcomes; quality of life

Abbreviations: DLCO = diffusion capacity of the lung for carbon monoxide; QLI = quality-of-life index; SF-36 = Short-Form 36 Health Survey; VA = Veterans Administration; VATS = video-assisted thoracic surgery

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While physicians are trying to predict which patients undergoing lung cancer surgery will die or have complications, patients are worried about the risk of long-term disability associated with lung surgery. This distinction is important because surgical resection remains the mainstay of curative therapy for lung cancer, the most common cancer killer for both genders in the United States. After consideration of tumor stage, surgical candidacy is dependent on severity of comorbidities, most of which are tobacco-related lung, heart, and peripheral vascular diseases. Multiple surgical series have examined such preoperative risk factors and patient cardiopulmonary physiologic parameters in relation to operative mortality. The long-term goal of surgical therapy includes not only improvement in survival, but also quality of life. A trend is now developing to objectively measure the quality of extended life gained with such therapy. It is predicted that functional assessment of patients after health-care interventions will play a more prominent role in the future. Little is known about the functional capacity and quality of life of patients after resection of lung cancer. Thus, a need exists for a more comprehensive understanding of the effects of thoracic surgery on patients’ functional and quality-of-life outcomes. The potential benefit (survival and/or symptom relief) of an operation must be weighed against these outcomes, a difficult task in the face of sparse data. Follow-up of patients with cancer to determine not only raw survival data but postsurgical quality of life has been advocated.

The objective of this study was to characterize the preoperative and 6-month postoperative functional health status and quality of life in patients undergoing lung cancer resection. Patients’ clinical characteristics and operative outcomes were correlated to preoperative and postoperative functional health status and quality of life.

Materials and Methods

We collected preoperative demographics, comorbidities, respiratory variables, and intraoperative and postoperative variables for patients referred for lung cancer resection. Functional assessment included Karnofsky performance status, American Society of Anesthesiology classification, and a 6-min walk. Respiratory variables included room air arterial blood gas analysis, complete spirometry, lung volumes and diffusion capacity of the lung for carbon monoxide (DLCO) measurement, Medical Research Council dyspnea scale results, and smoking history. Intraoperative variables included type of incision, extent of resection and lymph node dissection, operating time, estimated blood loss, and type/volume of intraoperative fluid administered. Postoperative variables included stage and cell type, complications, length of stay, discharge site, and mortality. Similar data were collected 6 months postoperatively. The Appendix details the complete listing of the > 90 demographic and clinical variables collected for each patient.

Functional health status was measured by administration of the Short-Form 36 Health Survey (SF-36), a standardized, validated, widely used instrument. The SF-36 measures eight scales: physical functioning, role functioning—physical, bodily pain, general health, energy, social functioning—role functioning—emotional, and mental health. Scoring is from 0 (worst) to 100 (best). Data for healthy population scores on the SF-36 are available for comparison with study populations. Quality of life was evaluated with administration of the Ferrans and Powers quality-of-life index (QLI). The QLI is a validated instrument with 5 subscales. The QLI subscales include overall quality of life, health and functioning, socioeconomic status, psychological/spiritual status, and family status. Scores are from 0 (worst) to 30 (best). Finally, a visual analog pain scale, a widely used and valid instrument, was administered with a scale of 0 (no pain) to 10 (worst). Patients completed these instruments preoperatively and 6 months postoperatively. All data were entered into a computerized database (Epi-info; CDC Shareware; Atlanta, GA).

Multiple thoracic surgeons performed pulmonary resections on lung cancer patients at three medical centers. The geographically and clinically diverse participating medical centers included an academic medical center, a Veterans Administration (VA) hospital, and a community tertiary-care medical center. Incisions for pulmonary resection were dictated by surgeon preference or anatomic imperatives. Lobectomy was the preferred extent of resection. Pneumonectomy was performed if oncologically necessary. Less-than-lobectomy resections were performed only if mandated by preoperative physiologic impairment.

Statistical analysis consisted of serial performance of multivariate analysis of variance tests. Independent variables were the clinical characteristics or outcomes, whereas the SF-36 or QLI subscale scores were the dependent variables. When comparing preoperative and postoperative performance on a variable, repeated-measures analysis of variance was used. To compare preoperative and postoperative scores, a matched-pairs t test was used. Analysis was carried out using software (SPSS version 10.0; SPSS; Chicago, IL); p ≤ 0.05 was considered significant.

To facilitate analysis, continuous variables were divided into clinically logical categories. FEV1 was divided into < 39% predicted values, 40% to 79% predicted values, and > 80% predicted values. The 6-min walk was divided into < 1,000 feet or > 1,000 feet. DLCO was divided into < 45% predicted values, 45% to 75% predicted values, and > 75% predicted values. Age was divided into decades.

Results

Patient Population

One hundred thirty-nine patients were studied. Sixty-two patients were enrolled at the academic medical center, 16 patients were enrolled at the VA medical center, and 61 patients were enrolled at the community tertiary care medical center. The mean ± SD age was 62.05 ± 10.62 years (range, 31 to 86 years). Fifty-nine percent of the patients were male, 32.4% of the patients were actively employed at the time of surgery, 40.3% of the patients were active smokers within 8 weeks of surgery, and 14.4%...
of the patients were being treated with corticosteroids. Mean values of FEV$_1$ were 2.13 ± 0.73 L; predicted values of FEV$_1$ were 76.0 ± 18.4%; predicted DLCO was 67.6 ± 20.3%; cigarette pack-years was 55.6 ± 36.5 years; and 6-min walk results were 1,358 ± 352 feet. Of the patients studied, 4.3% had undergone previous pulmonary surgery. Nonpulmonary comorbidities included cardiac (30.2%), use of digoxin or diuretics (23.7%), diabetes mellitus or its complications (15.9%), peripheral vascular disease (15.3%), and hemodialysis (2.2%). Of the patients studied, 5.8% had undergone previous chemotherapy and 6.5% had undergone previous radiation therapy. The only interinstitutional significant differences in these variables were lack of female patients and a significantly lower mean DLCO, both at the VA hospital.

**Operative Characteristics**

Incisions for pulmonary resection were as follows: posterolateral thoracotomy (57.6%), median sternotomy (36.7%), muscle-sparing thoracotomy (5.0%), and video-assisted thoracic surgery (0.7%). The extent of resection was as follows: lobectomy (77.7%), pneumonectomy (7.9%), segmentectomy (6.5%), chest wall resection (4.3%), and wedge resection (3.6%). Complete resection was performed on 136 patients. Operative time was 204 ± 88 min. Estimated blood loss was 541 ± 557 mL. Crystalloid fluid replacement was 2,228 ± 1,124 mL. Colloid fluid replacement was 122 ± 335 mL. Of the patients studied, 22.4% received blood transfusions.

**Pathologic Stage**

One hundred thirty-seven patients had complete surgical staging information (Fig 1). Data were missing for two patients. Stage IA had 43 patients (30.9%), stage IB had 46 patients (33.1%), stage IIA had 11 patients (7.9%), stage IIB had 18 patients (12.9%), stage IIIA had 16 patients (11.5%), stage IIIB had 1 patient (0.7%), and stage IV had 2 patients (1.4%).

**Postoperative Courses**

One hundred thirty-one patients were discharged from the hospital. There were eight hospital deaths, for an overall mortality of 5.8%. There was no significant difference in hospital deaths between medical centers. Causes of hospital mortality included pulmonary (n = 5), cancer related (n = 1), infection (n = 1), and other (n = 1). Figure 2 illustrates postoperative complications. Mean length of stay was 8.1 ± 6.3 days (range, 3 to 61 days); median length of stay was 6.0 days; 80.9% were discharged to home, 2.3% were discharged to a nursing facility, and 16.8% were discharged to an unknown location.

**Six-Month Follow-up**

One hundred three patients underwent a reevaluation at 6 months. Sixteen patients (12.2%) died during the 6 months of follow-up: 7 patients from cancer progression, 2 patients from respiratory failure, 1 patient from infection, and the remaining 6 patients died of unknown causes (2 patients refused follow-up and 4 patients were unavailable for follow-up). Six patients were awaiting reevaluation. Of the 103 patients, 13.1% underwent adjuvant chemoradiotherapy. At the 6-month follow-up, 7 patients had known metastatic disease and 22 patients were receiving pain medications. Cause of pain at 6 months included metastatic disease (n = 4), postthoracotomy (n = 3), neuropathic pain (n = 2), and other causes (n = 9). For the remainder of the patients, either no pain was noted or no data existed.

**SF-36**

Figure 3 illustrates the preoperative scores of patients with lung cancer who underwent surgery compared with age-matched, healthy control subjects from the general population. Significant impairment was noted in physical functioning (p = 0.026), role functioning–emotional (p = 0.004), mental health (p = 0.005), and energy (p = 0.044) in patients with lung cancer who underwent surgery. Interestingly, the preoperative pain subscale is better than normal (p < 0.001). Figure 4 depicts the preoperative scores vs the 6-month postoperative scores, indicating a significant persistent decline in physical...
functioning \((p = 0.001)\), role functioning–physical \((p = 0.037)\), social functioning \((p < 0.001)\), mental health \((p = 0.023)\) and, now, bodily pain \((p < 0.001)\). Figure 5 shows the 6-month postoperative scores vs a healthy, age-matched control population. A remarkable and durable reduction in physical functioning \((p < 0.001)\), role functioning–physical \((p = 0.002)\), role functioning–emotional \((p = 0.002)\), social functioning \((p < 0.001)\), mental impairment \((p < 0.001)\), and bodily pain \((p < 0.001)\) persists. However, the patients perceived normal levels of energy and general health status at the 6-month postoperative follow-up. No differences existed for preoperative or postoperative SF-36 scores relative to age or gender, with the exception of patients > 80 years old who had more preoperative bodily pain compared with the other age categories. The difference in results on the basis of age disappeared with the increased postoperative bodily pain experienced by all age categories at the 6-month follow-up reevaluation.

Analysis of the physiologic parameter categories of FEV\(_1\) and the 6-min walk revealed no preoperative or postoperative impact on functional health status. However, patients with DLCO < 45% predicted values experienced significant preoperative impair-
ment of physical functioning and role functioning—physical as well as postoperative role functioning—physical and bodily pain. Induction of chemoradiotherapy, extent of procedure, postoperative complications, and adjuvant therapy did not negatively affect functional health status as measured by the SF-36. Power of the foregoing analysis was \( \geq 0.90 \) for each variable discussed.

**QLI**

The analysis of preoperative and postoperative scores revealed no significant differences in the quality of life or subscales for the study group as a whole. Analysis of FEV\(_1\) and the 6-min walk categories demonstrated no effect on preoperative or postoperative quality of life or subscales. Again, a DLCO < 45% predicted foretold significantly poor scores of the preoperative quality of life and the health and functioning subscale in addition to the postoperative quality of life, health and functioning subscale, and psychological/spiritual subscale, as demonstrated in Figure 6. The relationship of preoperative age, FEV\(_1\), DLCO, and pathologic stage with the quality-of-life subscales and overall score is demonstrated in

![Figure 4](image1.png)

* p < 0.05

**Figure 4.** Functional health status (SF-36) and lung cancer surgery, preoperative vs 6 months' postoperative. See Figure 3 legend for definitions.

![Figure 5](image2.png)

* p < 0.05

**Figure 5.** Functional health status (SF-36) and lung cancer surgery, 6 months' postoperative vs normal. See Figure 3 legend for definitions.
Table 1. Induction chemoradiotherapy, extent of procedure, postoperative complications, and adjuvant therapy did not negatively affect the quality of life as measured by the QLI. The power of the foregoing analysis was ≥ 0.90 for each variable discussed.

Subjective dyspnea scores were significantly worse at the 6-month postoperative follow-up: preoperative, 0.61 ± 0.76; postoperative, 1.15 ± 1.03 (p < 0.001). Preoperative visual analog pain scores (1.34 ± 1.98) were significantly worse compared with postoperative scores (2.20 ± 2.58) [p = 0.001].

**DISCUSSION**

This study prospectively examined preoperative and postoperative functional health status and quality of life after pulmonary resection for lung cancer in 139 patients and analyzed these scores relative to

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**Table 1—Mean Postoperative Quality-of-Life Scores by Prognostic Indicator**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Overall Quality of Life</th>
<th>Health and Functioning Subscale</th>
<th>Social and Economic Subscale</th>
<th>Psychological and Spiritual Subscale</th>
<th>Family Subscale</th>
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<tbody>
<tr>
<td><strong>Stage</strong></td>
<td></td>
<td></td>
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<tr>
<td>IA (n = 32)</td>
<td>23.4</td>
<td>21.8</td>
<td>23.8</td>
<td>24.4</td>
<td>26.5</td>
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<td>IB (n = 31)</td>
<td>23.5</td>
<td>21.8</td>
<td>24.5</td>
<td>24.7</td>
<td>25.9</td>
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<tr>
<td>IIA (n = 10)</td>
<td>25.6</td>
<td>23.8</td>
<td>27.7</td>
<td>26.3</td>
<td>26.3</td>
</tr>
<tr>
<td>IIB (n = 14)</td>
<td>21.6</td>
<td>19.5</td>
<td>22.7</td>
<td>22.9</td>
<td>24.5</td>
</tr>
<tr>
<td>IIIA (n = 10)</td>
<td>23.1</td>
<td>20.9</td>
<td>23.5</td>
<td>24.7</td>
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<tr>
<td>IV (n = 1)</td>
<td>29.4</td>
<td>28.6</td>
<td>30.0</td>
<td>30.0</td>
<td>30.0</td>
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<td><strong>DLCO, %</strong></td>
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<td>&lt; 45 (n = 2)</td>
<td>20.1</td>
<td>17.5</td>
<td>21.3</td>
<td>20.9</td>
<td>25.6</td>
</tr>
<tr>
<td>45–75 (n = 57)</td>
<td>23.8*</td>
<td>22.0*</td>
<td>24.6</td>
<td>24.8*</td>
<td>26.6</td>
</tr>
<tr>
<td>&gt; 75 (n = 28)</td>
<td>24.1*</td>
<td>22.4*</td>
<td>24.8</td>
<td>25.4*</td>
<td>26.0</td>
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<tr>
<td><strong>FEV1</strong></td>
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<td>&lt; 40% (n = 3)</td>
<td>24.5</td>
<td>23.6</td>
<td>24.8</td>
<td>25.3</td>
<td>25.8</td>
</tr>
<tr>
<td>40–79% (n = 47)</td>
<td>23.3</td>
<td>21.5</td>
<td>23.9</td>
<td>24.7</td>
<td>26.3</td>
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<tr>
<td>&gt; 79% (n = 37)</td>
<td>23.5</td>
<td>21.5</td>
<td>24.8</td>
<td>24.5</td>
<td>25.9</td>
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<tr>
<td><strong>Age, yr</strong></td>
<td></td>
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<tr>
<td>&lt; 49 (n = 5)</td>
<td>20.3</td>
<td>18.5</td>
<td>21.0</td>
<td>21.2</td>
<td>22.8</td>
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<tr>
<td>50–59 (n = 17)</td>
<td>22.4</td>
<td>20.2</td>
<td>22.9</td>
<td>24.2</td>
<td>25.9</td>
</tr>
<tr>
<td>60–69 (n = 44)</td>
<td>23.5</td>
<td>21.7</td>
<td>23.9</td>
<td>24.8</td>
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<td>70–79 (n = 29)</td>
<td>24.5</td>
<td>22.4</td>
<td>25.5</td>
<td>24.9</td>
<td>26.4</td>
</tr>
<tr>
<td>80–89 (n = 4)</td>
<td>24.5</td>
<td>22.9</td>
<td>26.2</td>
<td>26.9</td>
<td>26.6</td>
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</table>

*Significantly different from other variable subgroups at the p < 0.05 level.
multiple clinical characteristics and outcomes. We demonstrated impaired preoperative physical and emotional functioning, mental health, and energy in lung cancer surgery patients compared with a healthy, age-matched control population. After lung cancer resection, these patients had further significant decline in physical, social, and mental states, as well as bodily pain at 6 months after surgery. Finally, compared with healthy, age-matched control subjects, remarkable and durable physical, emotional, social, and mental impairment as well as bodily pain were found in these patients 6 months after lung cancer surgery. The sole predictive clinical parameter was DLco < 45% predicted. Patients with poor DLco had worse preoperative physical functioning and quality of life in addition to worse postoperative quality of life, health and functioning, and psychological/spiritual status. To our knowledge, this is the first time a low DLco has predicted poor quality of life both before and after surgery. Previous studies found an increase in postoperative morbidity and mortality when the preoperative DLco was low. Ferguson et al\textsuperscript{15} noted that a low DLco was the only predictor of postoperative mortality and complications in 237 patients who underwent lobectomy or pneumonectomy for lung cancer. Markos and colleagues\textsuperscript{16} found that a predicted postoperative DLco of < 40% was the best predictor of postoperative respiratory failure, morbidity, and mortality.

A discrepancy exists between what physicians view as important in the postoperative period (mortality and complications) and what patients view as important (persistent physical disability). Paradoxically, physicians attempt to predict a transient state (the postoperative period), whereas patients are concerned about their more permanent postoperative circumstances.\textsuperscript{1} This point is underscored by our findings that although hospital mortality is an acceptable 5.8%, an additional 16 patients (12.2%) died during the 6-month follow-up period. This 6-month mortality data are disturbing and reiterate the need for improved understanding of lung cancer surgery patients for longer than the arbitrary hospital or 30-day mortality statistics that are generally reported.

The surgical literature is replete with studies\textsuperscript{4,6,17,18} examining patient demographics, cardiopulmonary physiology, and comorbidities that try to determine predictors of undesirable perioperative outcomes. Some publications have examined surrogates for functionality and quality of life. Postoperative cardiopulmonary function and exercise capacity have been examined after pulmonary resection, and demonstrated to be persistently decreased only by pneumonectomy.\textsuperscript{19,20} The unspoken leap of logic in such literature is that decreased cardiopulmonary capacity translates into decreased functional capacity and, presumably, quality of life for the patient.

Patient function and quality of life are outcomes that have been examined in “functional surgery” of the chest, such as lung transplantation and lung volume reduction surgery.\textsuperscript{10,21} However, very little data exist regarding a patient’s ability to function or the quality of life after resection of lung cancer, a procedure more frequently performed by orders of magnitude than either lung transplantation or lung volume reduction surgery. In Belgium, 92 quality-of-life questionnaires were sent to referring physicians after 100 major pulmonary resections. Thirty-one questionnaires were returned and showed no correlation between pain or dyspnea and extent of resection or postoperative lung function. However, quality of life was negatively influenced by pneumonectomy.\textsuperscript{22} Five hundred ninety patients ≥ 65 years old with breast, colon, lung, or prostate cancer were studied using the SF-36 physical functioning and role functioning–physical scales. The scale results were worsened by poor physical status before surgery, surgery, or the diagnosis of lung cancer.\textsuperscript{23} In Berlin, 20 patients were administered a quality-of-life questionnaire before surgery and serially after curative resection of lung cancer. Restrictions related to physical activities and disease symptoms predominated in decreasing quality of life, whereas emotional, social, and financial domain limitations were less frequent and less severe. In contrast to our study, Zieren et al\textsuperscript{24} found quality of life deteriorated after discharge from the hospital but was restored within 3 to 6 months for patients who were disease free.

Restorative surgery probably has a different impact on functional health status as opposed to patients undergoing cancer excision. Four hundred fifty-four patients undergoing total hip arthroplasty, thoracic surgery to resect lung cancer, or repair of abdominal aortic aneurysm underwent serial application of SF-36 and a quality-of-life instrument up to 12 months after surgery. At 1 month after surgery, significant physical and role limitations existed, but improvement was noted at 6 months and sustained up to 12 months for the patients who underwent total hip arthroplasty and abdominal aortic aneurysm.\textsuperscript{25} However, of the 123 patients undergoing lung cancer surgery, pain and all dimensions of health relating to physical construct declined 1 month after surgery, whereas mental health, role limitations secondary to mental health, and health perception did not decline. Subsequently, health perception declined by 6 months and remained depressed at 12 months in addition to persistent worsening of physical functioning and pain compared with preoperative levels. A contrasting report of 534 patients undergoing cardiac surgery within the Kaiser system showed significant improvement in all eight scales of the SF-36 within 3 to 6 months after surgery.\textsuperscript{26}
In the present study, pain is dominant in the postoperative, 6-month reevaluation. Logically, pain alone could account for most of the functional health status and quality-of-life issues identified. Incisional differences affect the possibility of long-term pain. A report of 22 video-assisted thoracic surgery (VATS) lobectomies compared with 22 thoracotomies for stage I lung cancer resection showed less chronic pain in the VATS patients.27 We previously published a large series of lung cancer resections using either median sternotomy or posterolateral thoracotomy. Chronic pain was noted in 12% of patients who underwent posterolateral thoracotomy vs 1% of patients who underwent median sternotomy.14

The preoperative SF-36 physical component has been shown to be a predictor of mortality after coronary artery bypass in 2,480 VA patients.28 Conversely, quality-of-life measures were not found to be predictive of pulmonary complications in a study of 117 patients who underwent thoracotomy for possible or definite lung cancer.29 Similarly, we detected no predictive value in the SF-36 or QLI in our 139 lung cancer surgery patients.

Information from this study should influence several clinical actions regarding lung cancer surgery. First, preoperative counseling should incorporate the findings that significant physical, emotional, social, and mental disabilities persists for at least 6 months after surgery. Second, technical modifications in the performance of lung cancer resection should be strongly considered to avoid debilitating, persistent postoperative pain. Such modifications could include minimal rib spreading during thoracotomy, VATS, or median sternotomy instead of thoracotomy as the approach of choice for lung cancer resection. In addition, participation in a formal pulmonary rehabilitation program may ameliorate the deleterious effects of both the underlying lung cancer and the operative procedure. Finally, postoperative pharmacologic intervention should be studied, such as a trial testing the effectiveness of antidepressants for several months after surgery.

Areas of future study should include the duration of postoperative multidimensional impairment and careful analysis of the impact of technical surgical modifications on functional health status and quality of life after lung cancer surgery. Basic research into the mechanism by which DLCO affects quality of life should be undertaken. Surgical societies should design and implement a simple data collection instrument, gathering essential patient data including demographics, functional status, quality of life, and physiologic parameters both before and after surgery. With multi-institutional data from a large patient population, a clinical prediction rule could be developed that would help advise pulmonologists and surgeons with a better degree of certainty who should undergo lung cancer surgery.

**Conclusion**

In summary, lung cancer surgery patients are sicker than the general population as documented by poorer functional status results. This depressed functional status persists for at least 6 months after surgery. Pain is a persistent postoperative complication of lung cancer surgery. A low preoperative DLCO is the only predictor of postoperative quality of life. A significant number of patients die following hospital discharge after lung cancer surgery. Preoperative chemoradiation, extent of resection, postoperative complications, and adjuvant therapy do not adversely affect functional health status or quality of life at 6 months after surgery.

**APPENDIX**

Abbreviations: SSN = social security number; Y = yes; N = no; Ht = height; Wt = weight; Hx = history; CABG = coronary artery bypass graft surgery; MI = myocardial infarction; vasc dis = vascular disease; RA = room air; TLC = total lung capacity; MRC = Medical Research Council; preop = preoperative; pul = pulmonary; rehab = rehabilitation; resect = resection; pneumonectomy = pneumonectomy; LN = lymph node; EBL = estimated blood loss; Path = pathologic; req = requiring; Rx = therapy; LOS = length of stay; pred = predicted; meds = medications; Postop = postoperative; rad = radiation; Readmit = readmission; synd = syndrome; met dz = metastatic disease; ASA = American Society of Anesthesiologists; HGB = hemoglobin; chemo = chemotherapy; exam = examination; adeno = adeno-carcinoma; pul = pulmonary.
APPENDIX 1

LUNG CANCER SURGERY OUTCOMES

9999=not obtain

I. Identification
Name: _______ Date of Surgery: _______ SSN: _______ Age: _______
Gender: _______ Ht: _______ Wt: _______ Employed Y N
SF 36__ Pain scale:____ Quality of Life Index: ____

II. Comorbidities
Diabetes Y N Albumin __________
Complications of diabetes Y N ASA class 1 2 3 4 5
Hx angina Y N Karnofsky status <50% 50-70% >70%
Hx CABG Y N
Hx MI Y N Creatinine ______
Current diuretic use Y N Preoperative chemo Rx Y N
Current digoxin use Y N Preop chest rad Rx Y N
Peripheral vasc dis Y N Renal dialysis Y N
Previous pulmonary surgery Y N

III. Preoperative Pulmonary Variables
RA PO2 ____________ Smoking Within 8 wks Y N
RA PCO2 ____________ Wheezing on exam Y N
FEV1 ____________L ______% pred Purulent sputum Y N
FVC ____________L ______% pred Oral steroids Y N
Dl,CO (corrected) ____________L ______% pred 6 min walk _______ ft
TLC ____________L ______% pred Cell type squamous adeno other
MRC dyspnea scale 0 1 2 3 4 Clinical staging T N M
Professional preop pul rehab Y N LN biopsy Y N

IV. Intraoperative Variables
Incision: thoracotomy muscle sparing thoracotomy VATS
median sternotomy
Procedure: wedge resect segment lobe pneumonect chest wall resect
LN dissect: none sampling dissection Comlete resection Y N
Operating time (skin to skin) ____min Transfusio N Y N
EBL ________ml
Fluid ________ml crystalloid ________ml colloid

V. Postoperative Variables
Path staging T N M ________ Cell type squamous adeno other
Ventilator >48 hr Y N Reintubation Y N
Pneumonia Y N Tracheostomy Y N
Lobar atelectasis Y N Pul embolism Y N
MI/ischemia Y N Readmit to ICU Y N
Atrial arrhythmia req Rx Y N Chest tube >5D Y N
Ventricular arrhythmia req Rx Y N Empyema Y N
Wound infection Y N Died during admission Y N
Postop LOS (days) ________ + pleural cytology Y N
Discharged to Home Nursing Home
Death Y N
Date of death ________ Cause: Cancer Cardiac Pulmonary Infection Other

VI. Six Month Follow-up (Loss of follow up: refused lost died)
Date: ________ Wt: ________
FEV1 ____________L ______% pred 6 min walk _______ ft
Pain meds Y N Karnofsky status <50% 50-70% >70%
Employed Y N Postop chemo Rx Y N
Postop rad Rx Y N Professional pul rehab Y N
Persistent smoking Y N Metastatic disease Y N
MRC dyspnea scale 0 1 2 3 4
Living in Home Nursing Home

Chronic pain: none post-thoracotomy synd neuropathy met dz other
Readmission(s): none ________ 1 2 3
Readmit cause: none pulmonary infection pain cardiac GI renal other
Clinical Investigations

REFERENCES


